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## ÆSTIVATION OF EPIPHRAGMOPHORA TRASKII IN SOUTHERN CALIFORNIA.

BY MRS. M. BURTON WILLIAMSON.

When the frost is on the ground and autumn leaves lie scattered over orchards and forests, it is no surprise to find that land snails (*Helices*) have begun their period of hibernation, and lie sheltered under the layers of dead leaves or hidden in decaying trunks of trees. The annual sleep of the snail in winter corresponds well with the enforced rest of the vegetable world; but in a tropical or semi-tropical climate the atmospheric conditions are different, and in place of a winter rest, snails take their annual sleep in summer. The hibernation of snails in colder countries is reversed, and in its stead æstivation of snails is the result. In the eastern states *helices* take their annual siesta in winter, but in southern California snails differ from their congeners, presenting an illustration of the power of environment in modifying instincts. Instead of going into winter quarters in October and remaining from four to six months without food and motionless, the greatest activity of the southern California *Helix* is during the winter months. The reason for this is that the food supply is plentiful in the winter when the warm rains prevail; and during the summer months the arid condition of the foot-hills, the habitat of these quiet creatures, made the æstivation of snails a necessity, a question of economy, an adjustment of demand and supply. In process of time the necessity for æstivation rather than hibernation became a habit.

When snails require rest in southern California they attach themselves to the under surface of dead cacti, pieces of wood, stones, or

burrow in the soil; in every case the aperture of the shell is upward, with the apex below. With its mucus the *Helix* securely glues this aperture to the under surface of any substance to which it attaches itself. These land snails, being non-operculated pulmonates, their apertures are covered by an epiphragm. (In experimenting on a number of *Helix tudiculata* and *Helix traski*, my experience has been that if the epiphragm has been badly punctured, or broken, the snail will die unless circulation is started by applying moisture.) This covering is composed of several layers of hardened mucus which resembles the tough white skin that lines a hen's egg.

In experimenting with helices in a snailery, a wooden box covered with a wire screen and partly filled with soil, I have found that while one species of snail (*Epiphragmophora traskii* Newc.) would fasten themselves to the strip of wood that braced the lid of the snailery, the other species (*Glyptostoma newberryanum* W. G. B.) would burrow in the soil, their black shells almost hidden from sight. In order to test them I have repeatedly interrupted their æstivation by placing their shells in luke-warm water until the helices could crawl about, but they would eventually be found in separate places, *E. traski* suspended above and *G. newberryanum* below in the soil.

During æstivation the snail's functions are in a state of coma, respiration is nearly suspended, and having retired as far as possible within the shell the mollusk is the embodiment of rest. Its waking is not a voluntary action. Without humidity the snail will æstivate for months and continue in a state of torpor for years if the atmosphere is dry around it. Conchologists frequently quote the example given by Dr. R. E. C. Stearns, of the U. S. National Museum, of a Lower Californian *Helix* that rested, or rather remained in a state of torpor for six years! Other cases of prolonged relaxation of the vital functions of snails are recorded.

Some years ago, in March, 1890, I collected a few land snails (*E. traski* Newc.) from some of the low foot-hills in Los Angeles, and on reaching home, finding them glued to the glass jar, they were left on a stand. In the morning two snails had crawled out of the jar and up the wall and were snugly ensconced in one corner of the ceiling, another one had traveled far in the night and had pre-empted his claim in one corner of the hall ceiling. In order to study developments they were allowed to remain *in situ*. One soon fell down upon the carpet but the other two remained intact. The

household orders were that the helices were to be left undisturbed by brush or broom. The summer came and went, autumn followed, winter came on and still our hermaphrodites "held the fort." No sound of mirth nor music aroused them.

But the rains came on, heavy drenching showers that rushed down the mountains, washed the foot-hills, overflowed the ozanjas, and all nature was in a dripping condition. During one of these storms in January, 1891, the rain came down with such force that it made invidious incursions into the hall during the night, and the snail was found on the floor. In an hour it was as willing as ever to struggle for existence. It ate heartily of celery with its little rasping tongue (radula) beset with multitudes of tiny siliceous teeth.

It was not until February 23 that the other *Helix* had been sufficiently overcome by the forces of nature to loosen its epiphragm enough to descend to the floor. It was placed in a shallow saucer of water, and it assumed its functions as though they had not been arrested.

While these house snails were glued to the ceilings, their relatives in the snailery in the garden had been aroused to activity by the first rain as it pattered through the screen cover; and on January 2, 1891, I found a number of tiny pellucid-looking balls carefully hidden in the moist earth in the snailery. These were the eggs of the snails. In less than three weeks there were young snails. Time had been lost by the house snails, their æstivation extending beyond the requirements of nature had gained them nothing.

It was my intention to study all these forms, and while giving a rest to the "house snails," compare their longevity with the garden helices. But, alas, for the rapacity of the animal kingdom, sowbugs, ants and insects from the rose bushes made war upon the whole snail colony, adults, babies and eggs, and by summer time the houses were empty, the tenants were gone!

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#### A NEW SPECIES OF LIMA.

BY W. H. DALL.

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Recent excavations involved in the construction of a tunnel through a hill at Los Angeles, California, on the line of Third street, have developed the presence of fossils, probably Pliocene, in the blue clay through which the tunnel is being cut.